REMARKS/ARGUMENTS

Summary of Office Action

Claims 103 to 209 were pending prior to the last office action. Claims 103 to 137, 138 to 147, 148 to 151, 152 to 155, 156 to 163, 164 to 171 and 172 to 209 were rejected under 35 U.S.C. 112; claims 103 to 137, 138 to 147, 148 to 151, 152 to 155, 156 to 163, 164 to 171 and 172 to 209 were rejected under 35 U.S.C. 101; and claims 103, 138, 148, 152, 156, 164 and 172 were rejected under 35 U.S.C. 102.

Applicants wish to thank the Examiner for extending the courtesy of a telephone interview on October 10, 2007. The interview was attended by the Examiner, Robert Hercus (the inventor), Keith Callinan (advisor to Mr. Hercus) and David Bailey (Applicants' counsel). During the interview, Mr. Hercus explained the origin of his invention, its function and its capabilities. The Examiner indicated a number of neural network models that he considered to be relevant including the ART and Cascade-Correlation models. The rejections under 35 U.S.C. § 101 and the case of In re Comiskey were also discussed. No conclusion was reached with respect to the patentability of the claims.

Response

Rejection in light of 35 USC § 112

Claims 103 – 161, 164 – 184, and 186 – 209 were rejected under 35 USC § 112 as failing to comply with the enablement requirement, because the claims lack utility. Applicants confess that they were surprised by the issuance of a rejection for lack of utility. The pending application relates to novel Artificial Neural Networks. Artificial Neural Networks are used in a variety of applications. The specification of the above

referenced application itself notes that embodiments of the invention can have utility including (specification, p. 27, lns. 6 – 10):

> Thus the network is able to recognise patterns within patterns of associations. As such it may be of use in varying industries such as, for example, monitoring and predicting stock price movements, internet surveillance, security, computer virus detection, phrases in speech and text, clauses in speech and text, plagiarism detection, data compression, and so forth.

The MPEP sets out the circumstances under which a rejection for lack of utility is appropriate. The MPEP's requirements include (see MPEP § 2107):

> ...
>
> (B) Review the claims and the supporting written description to determine if the applicant has asserted for the claimed invention any specific and substantial utility that is credible:
>
> (1) If the applicant has asserted that the claimed invention is useful for any particular practical purpose (i.e., it has a "specific and substantial utility") and the assertion would be considered credible by a person of ordinary skill in the art, do not impose a rejection based on lack of utility.
>
> ...

In light of the fact that the specification of the above referenced application specifically asserts uses for embodiments of the claimed invention, the rejection of the claims for lack of utility is entirely inappropriate. Therefore, Applicant respectfully request that the rejections under 35 USC § 112 be withdrawn.

Rejection in light of 35 USC § 101

The Examiner has referred to In re Stephen W Comiskey (decided on September 20, 2007). With all due respect, we believe this case proves that the applicant's invention as claimed is patentable subject matter under Section 101.

It is clear the independent claim of Comiskey did not require the use of a mechanical device such as a computing device. It was in relation to "an automated system and method for recording resolution through binding arbitration. In essence, the method claimed covered a manual system and the performing of mental testing. That can be contrasted with the present application as it is directed to an "artificial neural network". Any person having basic knowledge of artificial neural networks, and particularly a person of ordinary skills in the art, will know that an artificial neural network can only exist in a computing environment. It inherently requires the use of a mechanical device such as a computing device. As that is inherent it therefore distinguishes the present case from Comiskey.

In Comiskey there were four dependent claims (claims 15, 30, 44 and 58) that all inherently required the use of a computing device or other machine but without actually mentioning a computing device or other machine. As was required in all four claims:

> "access to the mandatory arbitration is established through the Internet, intranet, World Wide Web, software applications, telephone, television, cable, video or radio, magnetic, electronic communications or other communications means."

It is inherent that some form of mechanical device or computing device is required for telephone, television, cable, video, radio, magnetic, electronic communications or other communications means. The Court upheld those four claims as having patentable subject matter under Section 101, because a computing device or other mechanical device is inherent if one is to use the Internet, an intranet, the World Wide Web, or software applications.

Therefore, in view of the Court upholding those four claims, the Court, has agreed that the computing device or other mechanical device does not need to be specifically mentioned in the claim but must be inherently required.

This is further supported by In Re State Street Bank where the invention involved "a data processing system". It did not inherently state that a computing device is required but the specification makes it clear that a computing device or equivalent device was a virtual necessity to perform the task.

Under portion C of the judgment on page 22, claim 17 of Comiskey recites "a means for selecting arbitrator from an arbitrator database". The Court held that claims 17 and 46, **under the broadest reasonable interpretation**, could require the use of a computing device as part of Comiskey's arbitration system. Furthermore, on claim 23 the Court further made it clear that an unpatentable mental process combined with a machine may produce patentable subject matter. And further again referring to State Street Bank "a computer or equivalent device was a virtual necessity to perform a task".

The Court's conclusion was that independent claims 17 and 46 and their dependent claims, (in addition to dependent claims 15, 30, 44 and 58), recited statutory subject matter. That is despite those claims not referring to a computing device. The Court relied upon the computing device being inherent, and the broadest reasonable interpretation of the wording of the claims.

We therefore believe this case supports the patentability under Section 101 for the present claims, even though they do not specifically refer to a computing device, as a computing device is inherently required to be able to perform the necessary tasks. That is understood to a person of ordinary skills in the art from the use of the term "artificial" to describe the claimed neural networks, which immediately takes the claimed subject matter totally out of the world of <u>mental</u> processes. Furthermore claims 208 and 209 support the inherent nature of an artificial neural network requiring the use of a computing device. Similarly for claims 124, 146, 150, 154 and 197 due to the

reference to "input data"; claims 128, 129, 186 and 187 due to the reference to "memory"; and claims 130, 132, 136, 188 and 206 due to the reference to "node" and/or "array".

On page 4 of the second office action the Examiner states "Clearly, in hardware or software new elemental neurons cannot be added at any time, anywhere in the neural structure". We refer the Examiner to paragraph [0078] of the published application where the creation of elemental neurons is explained.

Rejection in light of 35 U.S.C. § 102

A. Disclosure of the Citations

1. The Cascade-Correlation Learning Architecture (CCLA) as published by Scott E. Fahlman and Christian Lebiere on August 29, 1991. During the telephone interview with the Examiner, the Examiner mentioned this Fahlman et al. publication ("Fahlman et al. publication"). To place a copy on the written record, a copy is submitted herewith in an Information Disclosure Statement. We submit that the Fahlman et al. publication is of limited, if any, relevance to the claims of the present application as they now stand. There are several disclosures within the Fahlman et al. publication that make it clear why it is of limited relevance. In page 2 it is stated in the final paragraph:

> "The cascade-correlation algorithm uses an extreme version of this technique, allowing only one hidden unit to evolve at any given time."

At the beginning of page 3:

> "The first is the *cascade architecture*, in which hidden units are added to the network one at a time and do not change after they have been added. The second is the learning algorithm, which creates and installs the new hidden units. For each new hidden unit, we attempt to maximize the magnitude of the *correlation* between the new unit's output and the residual error signal we are trying to eliminate."

As is clear from the description in the fourth paragraph from page 3 of the Fahlman et al. publication and from the drawings on page 4:

"Each new hidden unit received a connection from each of the network's original inputs and also from every pre-existing hidden unit."

One only has to consider the drawings of the Fahlman et al. publication on page 4 to realize that all inputs are connected to all outputs. Furthermore, each new neuron that is created changes its value until residual error signal is minimized. It is only when the residual error signal is minimized that the value of the neuron is fixed. This is confirmed from page 5 of the Fahlman et al. publication at the middle of the page:

"When *S* stops improving, we install the new candidate as a unit in the active network, freeze its input weights, and continue the cycle as described above."

This is also confirmed by the second last paragraph on page 5. On page 6, in the final paragraph, is an important indicator of difference:

"The net has two continuous-valued inputs and a single output."

It further states that it has 194 training cases. Therefore, it has 194 total inputs. The inputs are the X Y co-ordinates of the dots in the spiral. There are 194 dots in the spiral. Therefore a change in the input value of X and Y change the output. The input values are continuously changing and will have 194 values. Every neuron is activated every time as all inputs are connected to all outputs. The output is the value. With the present application the input would be the X and Y co-ordinates, and the outputs would be the X and Y co-ordinates and the value.

We further note that the system described in the Fahlman et al. publication is a 1-way system, meaning that the Fahlman et al. publication does not disclose the capability of the system to perform expression.

In summary, the structure of the CCLA is characterized in that it requires each newly added hidden unit to be connected to all of the inputs, all of the existing hidden units and all of the outputs. Due to the structure of the CCLA, the newly added hidden unit does not generate an output based simply on the other hidden units to which it is connected, but by varying the output function of the hidden unit in a way that depends upon a residual error calculation.

The CCLA is further characterized in that the process used to determine the output function of a hidden unit requires multiple passes through the training data to reduce error and then the addition of a new hidden element followed by further iterations through the training data to reduce error. A process that is likely to involve considerably more computational effort than a process that only requires a single pass through the training data to construct an artificial neural network.

2. During the telephone interview, the Examiner also referred to artificial neural networks of the Adaptive Resonance Theory ("ART"). Again, for the sake of the record, two papers that explain aspects of this technology are submitted in an Information Disclosure Statement herewith.

3. US Patent 5,091,864 to Baji (Baji). Baji was cited in the Office action and describes a system where the input value is changed constantly and that is not able to create new neurons. At column 5, line 35 Baji makes it clear that there are separate signal lines for input and output data. Furthermore, Baji does not disclose expression

of the input values or that any one neuron always represents a unique value when it is created.

Furthermore, Baji requires a single layer, and is not a multi-layer structure. The single layer has N neuron circuits which sum the results of the multiplication of each of N input signals [Xi(j=1 to N)] by a coefficient mij to produce a multiply-accumulate value. Also, each systolic PE assumes different values over time.

B. Differences of the Claimed Invention Over the Citations.

Rejection of claim 103

Applicants respectfully submit that the prior art of record does not disclose the combination of claim 103 including "a plurality of neurons ... comprising a plurality of structural neurons ... each structural neuron being configured to:

(i) receive input from a pair of neurons of the plurality of neurons and with which it is an associating neuron; and

(ii) express that input as an output to that pair of neurons to activate the pair of neurons for expression"

In addition, the prior art of record does not teach the combination of claim 103 including "a plurality of neurons ... comprising a plurality of elemental neurons ... each elemental neuron being configured to:

(i) represent a unique value into the artificial neural network, ...

(ii) express that unique value as an output when activated by a structural neuron;"

In light of the failure of the prior art of record to teach the combination of claim 103, Applicants respectfully submit that claim 103 is allowable.

Rejection of claims 104 - 137

Applicants respectfully submit that claims 104 – 137 are allowable for reasons including that claims 104 – 137 depend from an allowable base claim.

Rejection of claim 138

Applicants respectfully submit that prior art of record does not teach the combination of claim 138 including "a plurality of neurons ... the plurality of neurons comprising a plurality of elemental neurons ... each elemental neuron being configured to:

(i) represent a unique value able to be input into the artificial neural network, the unique value being one of: a stimulus, an event, events, a sequence in a pattern or sequence of events; and

(ii) express that unique value as an output; and

(f) each structural neuron being configured to receive input from a pair of neurons with which it is associating, the pair of neurons being selected from the group consisting of: both elemental neurons, both structural neurons, one structural and one elemental neuron, and one elemental neuron and one structural neuron."

Therfore, Applicants respectfully submit that claim 138 is allowable.

Rejection of claims 139 - 147

Applicants respectfully submit that claims 139 – 147 are allowable for reasons including that claims 139 – 147 depend from an allowable base claim.

Rejection of claim 148

Applicants respectfully submit that none of the prior art of record teaches the combination of claim 148 including "a plurality of neurons ... the plurality of neurons comprising a plurality of elemental neurons and a plurality of structural neurons ... each elemental neuron being configured to:

(i) represent a unique value able to be input into the artificial neural network system, the unique value being at least one selected from the group consisting of: a stimulus, an event, events, a sequence in a pattern, a sequence of events, an elemental stimulus, a defined elemental pattern, a defined elemental data element, a basic input stimulus, and an output stimulus of information being processed; and

(ii) express that unique value as an output;

f) all of the plurality of structural neurons being able to be expressed in terms of the elemental neurons from which they were derived or represent."

Therefore, Applicants respectfully submit that claim 148 is allowable.

Rejection of claims 149 – 151

Applicants respectfully submit that claims 149 – 151 are allowable for reasons including that claims 149 – 151 depend from an allowable base claim.

Rejection of claim 152

Applicants submit that none of the prior art of record teaches the combination of claim 152 including "An artificial neural network ... the artificial neural network being bi-directional and being able to operate in a forward mode where structural neurons

are created from input events from the elemental neurons, and in a reverse mode where input events are expressed by the elemental neurons."

Therefore, Applicants respectfully submit that claim 152 is allowable.

Rejection of claims 153 – 155

Applicants respectfully submit that claims 153 – 155 are allowable for reasons including that claims 153 – 155 depend from an allowable base claim.

Rejection of claims 156

Applicants respectfully submit that the prior art of record does not teach the combination of claim 156 including "A neuronal assembly ... comprising an initiating neuron, an associated neuron and an associating neuron operatively connected with the initiating neuron and the associated neuron; the associating neuron representing the sum of what is represented by the initiating neuron and the associated neuron, and once the associating neuron represents a result, the result need not be created in another neuron."

Therefore, Applicants respectfully submit that claim 156 is allowable.

Rejection of claims 157 – 161

Applicants respectfully submit that claims 157 – 161 are allowable for reasons including that claims 157 – 161 depend from an allowable base claim.

Rejection of claim 164

Applicants respectfully submit that the prior art of record does not teach the combination of claim 164 including "

activating or producing an output from the associated neuron to potentiate and activate the associating neuron, the associating neuron then being activated and able to produce an output; the associating neuron representing the sum of what is represented by the initiating neuron and the associated neuron, and once the associating neuron represents a result, the result need not be created in another neuron." Therefore, Applicants respectfully submit that claim 164 is allowable.

Rejection of claims 165 - 172

Applicants respectfully submit that the prior art of record does not teach the combination of claim 172 including:

"defining unique events the elemental neurons will represent;

creating a required number of elemental neurons for the total number of unique values to be represented for all defined events; .....

the plurality of elemental neurons receiving all input to the artificial neural network, all output from the artificial neural network being from the plurality of elemental neurons;

creating the plurality of structural neurons, each of the structural neurons being created by the association of a pair of the plurality of neurons;

each of the plurality of structural neurons being configured to produce an output on activation by the pair of neurons, the pair of neurons comprising an initiating neuron and an associated neuron;

the association of the plurality of neurons being based on proximal characteristics; and

each of the plurality of structural neurons being configured to express its input to the pair of neurons."

Therefore, Applicants respectfully submit that claim 172 is allowable.

Rejection of claim 173 – 184, and 186 - 209

Applicants respectfully submit that claims 173 – 184 and 186 – 209 are allowable for reasons including that claims 173 – 184 and 186 – 209 depend from an allowable base claim.

C. Conclusion

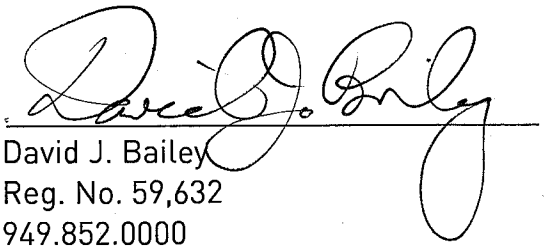
It has been noted that the drawings contain an error in that Figures 1, 2 and 3 should be labelled as "prior art". That is now corrected with the present response.

In light of the above, Applicants respectfully submit that all of the currently pending claims are allowable. Consequently Applicants respectfully request the prompt issuance of a Notice of Allowability.

If Applicants' counsel can be of any assistance, please do not hesitate to contact them at the number listed below.

Respectfully submitted,

KAUTH, POMEROY, PECK & BAILEY LLP

By: 

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